

DOCUMENT RESUME

ED 163 770

FL 009 857

AUTHOR Macken, Marlys A.
TITLE Developmental Reorganization of Phonology: A Hierarchy of Basic Units of Acquisition. Papers and Reports on Child Language Development, No. 13.
INSTITUTION Stanford Univ., Calif. Dept. of Linguistics.
PUB DATE Aug 77
NOTE 37p.
EDRS PRICE MF-\$0.83 HC-\$2.06 Plus Postage.
DESCRIPTORS *Child Language; Cognitive Processes; *Consonants; *Language Development; Language Patterns; Language Research; *Linguistic Performance; Linguistic Theory; Longitudinal Studies; Mexicans; Phonemics; *Phonological Units; Phonology; Preschool Children; Psycholinguistics; Spanish; *Spanish Speaking; Speech Communication; Syllables; *Verbal Development

ABSTRACT

The acquisition of the consonant system by a child acquiring Mexican-Spanish as her native language is described. During the earliest stages (from 1;7 to 2;1 years of age), the data showed several phenomena that could best be accounted for by assuming a central role for the word as the basic unit being acquired. The evidence for the centrality of words and word patterns in the child's early development is the main focus of the analysis. During the later stages (from 2;2 to 2;5), most of the evidence for words and word patterns disappeared, and the child's phonological system during this period can be described adequately in terms of phonemic contrasts and the more traditional phonological rules. The analysis covers the child's phonology at the beginning of the study (age 1;7), early phonological development (1;8 to 2;1), the learning of word patterns, the learning of phonemic contrasts, the child's development from 2;2 to 2;5, segmental system, co-occurrence of consonants, syllable structure, a model of phonology acquisition, universals of acquisition, and individual differences. (SW)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

DEVELOPMENTAL REORGANIZATION OF PHONOLOGY: A HIERARCHY OF BASIC UNITS OF ACQUISITION¹

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Marlys A. Macken
Child Phonology Project
Stanford University

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Eve V. Clark

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC) AND
USERS OF THE ERIC SYSTEM."

1.0 Introduction

This paper describes the acquisition of the consonant system by one child acquiring Mexican-Spanish as her native language. During the earliest stages (from 1;7 to 2;1 years of age), the data from this child--referred to here as Si--showed several phenomena that could best be accounted for by assuming a central role for the 'word' as the basic unit being acquired. Words were, for Si, prosodic units, each being selected for a particular output form on the basis of the component consonants and each processed in flexible ways to achieve preferred output patterns. The evidence for the centrality of words and 'word patterns' in Si's early development will be the major focus of this paper. During the later stages (from 2;2 to 2;5), most of the evidence for words and word patterns has disappeared, and Si's phonological system during this period can be described adequately in terms of phonemic contrasts and the more traditional phonological rules.

The picture of phonology acquisition which emerges from these data is then one in which there are at least two and possibly three basic units--the 'word', the 'phoneme' and possibly the 'feature'--which figure significantly in the developmental process. It appears, moreover, that the word is more important in the earliest stages, and that in the later stages, the phoneme replaces the word as the basic structural unit of the phonological system. In the final section of the paper, the relevance of these data for some aspects of a general model of phonology acquisition is discussed.

1. This research is part of the activities of the Stanford Child Phonology Project and was supported by a National Science Foundation Grant (SOC 74-0316 A01). I would like to thank: Charles A. Ferguson for support during all phases of the research; Debby Ohsiek, Maria Rodriguez and Ana Ortiz for their assistance during the data collection phase; and Lise Menn for many helpful comments on a draft of the paper. The analysis of Si's data reported here was part of a separate paper given at the Stanford Child Language Seminar Series May 1976; a preliminary version of this paper was given at the November 1976 meeting of the Stanford Phonology Group.

ED163770

F70 09857

2.0 Data collection and analysis

Si was one of six children who participated in a longitudinal study designed to investigate the acquisition of consonants in monolingual Mexican Spanish speaking children. All the subjects were seen once a week for a ten month period. Each child was recorded individually at a community center near their homes in Redwood City, California.

During each session, the child was tape-recorded for fifteen to thirty minutes, while interacting with the experimenter (E), a native speaker of Mexican Spanish. Recording was done on a Uher 4000 tape recorder with a Sony Electret microphone (attached to a soft cloth vest which the child wore). Stimulus materials included picture books, index cards picturing common objects and small toy objects. When the children were not being recorded, they remained in a playroom. Notes were taken in the playroom by a research assistant. These notes, which included words which the child used, were used subsequently by the E during recording sessions in order to elicit as many of the child's vocabulary items as possible. Word lists were collected from the parents every two weeks and were also used by the E during recording sessions.

During the week following the session, transcriptions were made of all tapes, by two transcribers working independently and using Revox A77 tape recorders with Super St-Pro B-V headphones. Two procedures were used to combine the individual transcriptions of each utterance into a final one (Macken 1976a). The transcription system used is that of the International Phonetic Association, with a supplemental symbology developed by the Stanford Child Phonetics Workshop (Bush et al., 1973). Consonants were transcribed narrowly and vowels somewhat more broadly. In this paper, Si's phonetic segments and phonetic sequences will be given in square brackets, [...], the typical notation for such segments in descriptions of adult speech. Her phonemes and phonemic sequences will be enclosed however by vertical straight lines, [...]--a notational device used by Smith 1973. The more usual slant lines, /.../, will be reserved for phonemes or phonemic sequences of adult Spanish only. Although Si's data was transcribed quite narrowly, examples of phonetic sequences when used in the following text will be given in no narrower a transcription than that necessary for the particular point being made.

3.0 The subject

Si was exactly 1;7 at the beginning of the study and was just barely 2;5 at the end. She is the youngest of seven children; she has three

brothers (ages 17, 15 and 6 years at the beginning of the study) and three sisters (ages 13, 11 and 8 years at the beginning of the study). She was born in Redwood City, California to parents who had moved there from Michoacán, and the family speaks only Spanish in the home.

However, since both parents work and speak English at their places of employment and since all of her siblings attend English speaking schools, Si may have been exposed to some English. During the first several months of the study, Si was cared for by a monolingual Spanish speaking neighbor. She subsequently was enrolled in a day care program for Spanish-speaking children which was staffed by native speakers of Spanish; nearly all the children enrolled were monolingual Spanish-speaking children. During the period from 1;7 to 2;2.15, Si's environment was almost exclusively Spanish-speaking, and her exposure to English is presumed to have been minimal.

When she was 2;2.15, she was transferred to another day care program, in which were enrolled many monolingual English-speaking children. It was reported to us by the program's staff that Si began learning English very quickly. During the period from 2;2.15 to 2;5, she used several English words during our sessions: apple, phone, shoe(s), car, puppy, and mommy home were used frequently; hi and monkey were used once; and donkey, sun and berry are possible English glosses for utterances produced in ambiguous contexts.

Over the ten month period of the study, Si was recorded on 35 of the total 41 sessions. During this time, she spontaneously produced nearly 200 recognizable words; the corpus of spontaneously produced speech contains 2,536 tokens and accounts for 51% of her total recognizable speech. In imitation, she produced 2,463 tokens of both the same words and many other words which she never produced spontaneously. From the very beginning, Si imitated more than any other subject in the study and more than any of the children reported in Bloom et al. 1975.

During a preliminary analysis in which spontaneous and imitated forms were compared word by word for the first three months, it became clear that the relationship between spontaneous and imitated forms was a complicated issue: imitations were neither always in advance of spontaneous forms nor necessarily predictive of spontaneous development. To avoid including for analysis productions which did not accurately reflect Si's own phonological system, it was decided to analyze these two types of productions separately. In this paper, only the analysis of spontaneously produced speech will be reported.

There were several aspects of Si's speech that were particularly striking and are relevant to her phonological development: her use of a pre-utterance vowel; the diminished phonetic accuracy that occurred when she

produced words in phrases; her use of consolidated 'unit phrases' and 'routines'; and her 'misperceptions'. The first three characteristics of her speech, together with several other factors, contributed to the enormous amount of phonetic variation which was the hallmark of her productions, which set her distinctly apart from the other subjects and which presented the first obstacle to the phonological analysis. All four aspects of her production are relevant to general features of her phonology and, in particular, to the role that the 'word' as a phonological unit played in her development.

As previously mentioned, there were significant phonetic differences between her spontaneous and imitated forms. Another source of variation was her use of a pre-utterance vowel. From 1;7 to 2;5, 19% of all spontaneous utterances and 20% of all imitated utterances were produced with a prefixed 'filler' which was almost always a neutralized vowel, but which could be a syllabic consonant or a syllable of the form CV; in rare cases, she added a filler (either a vowel or a syllable) to the ends of utterances. This 'pre-utterance vowel' occurred freely, and no restriction of its occurrence to particular words, word classes or phonetic environments could be discerned. Although there were several changes in the frequency with which this vocalic segment occurred, the uniformity of its appearance over the ten-month period indicates that it was a general characteristic of her speech, perhaps an initiation-of-speech phenomenon.

Obviously, the pre-utterance vowels presented problems for analysis. Particular occurrences of it could variously be interpreted as an article, a verb form, the unstressed initial syllable of a particular word, etc. In any particular case, any of these interpretations would have consequences for the phonological analysis. Since the interpretation of these vocalic segments was problematic, it was decided to treat all occurrences as a single phenomenon. Thus, they were not counted as independent words in the session tabulations for words and tokens, and they were ignored in the phonological analysis. A possible consequence of this decision is the under-estimation of Si's abilities. For example, she was not credited with the acquisition of some articles and the verb forms es and está until late in the study when clear evidence obtained. Similarly, she was not credited with the ability to produce three syllable words until three syllable words of the form [CVCVCV] were produced; words with an initial unstressed vowel syllable (like araña 'spider') remained difficult to interpret. If in fact the pre-utterance vowel represents an attempt on Si's part to designate semantic properties such as definite/indefinite reference, then it is the case that this attempt preceded any other evidence of such semantic knowledge by many months. Alternatively, its use could merely represent an attempt to replicate the length and form (without content) of adult utterances. In any event, the use of these vocalic segments is consistent with her general tendency to embed a word in a longer carrier. In fact during the earliest sessions, Si frequently produced long, basically unanalyzable utterances in which only one recognizable word occurred.

When Si began to combine two recognizable words, the phonetic accuracy of both words decreased. In many of these two word sentences, she consolidated the two (polysyllabic) source words into one, smaller (e.g., two syllable) form. In the resulting two syllable 'sentence', only one syllable of each word was produced; in contrast, when these words were produced in isolation, they were rarely, if ever, produced as a single syllable only. Possibly similar to this was the way in which she consolidated learned routines: for example, *¿qué es?* 'what is?' → [kes]². It seems that Si's willingness to use 'large units' (e.g. long words, sentences and routines) while at the same time having only limited production abilities (and/or limited semantic knowledge) led to the phenomenon of such 'coalesced' or consolidated units and sentences. This phenomenon is directly related to the most striking feature of her phonology--her use of 'coalesced word patterns'. For the phonological analysis of such routines, the surface form of the unit phrase was treated as being the phonological form also (since the component words did not occur separately). The phonological structure of individually occurring words was determined on the basis of their most frequently produced form in isolation.

One way of looking at Si's consolidation of routines and phrases would be that these routines were in fact units for her, stored and used as wholes. This interpretation would also be relevant for an analysis of her 'misperceptions', imitations in which she misperceived the adult model and produced a different, but phonetically similar word. The frequency of misperceptions throughout the study was characteristic of only Si among the six subjects. For example, E's *Armando* was repeated by Si as *Fernando*, *león* 'lion' as *avión* 'airplane', *gallo* 'rooster' as *caballo* 'horse', *limón* 'lemon' as *jamón* 'ham' and *taza* 'cup' as *casa* 'house'. In all of these examples, the two words involved are phonetically similar but are not visually or semantically similar. In these misperceptions (which could be called 'slips of the ear') and in the case of the unit routines, words (and phrases) are whole units. For the adult, these words are specifically segmented, but for Si these words seemed to have primarily only a general 'prosodic shape' which she then used as the basis for her output. As will be discussed, the phenomena of unit phrases and misperceptions are similar in important ways to aspects of her phonological development in that all three are suggestive of a system in which the word is a unitary whole which has a general prosodic shape (perhaps as yet unanalyzed segmentally) and which can be prosodically similar in a loose way to other words.

The 'misperceptions' are also important in that they suggest an

2. Although we do not know how Si's parents pronounce this phrase, it is likely that adults (in fast speech) also delete one of the two vowels; however, the other children used [ke] when requesting information in comparable situations. *La niña* is another example of a unit phrase (see footnote 6).

obvious explanation for why there was such an inconsistent relationship between the imitated and the spontaneous productions. Clearly there are two kinds of imitation. There is 'true' imitation, and there is also behavior which would more appropriately be called 'repetition'. In the first case, Si was listening carefully to the model and fairly accurately mimicked the word, while in the latter case, she was repeating the word but giving her version of it and not necessarily listening carefully. This would explain why some of her imitations were phonetically better than her spontaneous productions of the same words, while other 'imitations' were the same as her spontaneous forms. In those cases where her imitations were poorer replicas of the model word than her spontaneous form of the same word, other performance factors were operating.

4.0 Si's phonology at the beginning of the study (1;7)

Si is learning the phonological system of the variety of Spanish spoken by her family and neighbors, almost all of whom come from the state of Michoacán in Mexico. Since the Project did not analyze the phonology of the subjects' parents, and since no phonological analyses of Michoacán Spanish have been done, the adult phonology to which Si is progressing is by necessity presumed to be that of general Mexican Spanish, a variety which has received considerable attention from linguists. As in general Spanish, the basic sound classes are stops, fricatives and sonorants. The feature of voicing is distinctive in the stops /ptk/ versus /bdg/ and in the fricatives as /fsx/ versus [βɣ]. However, the voiced fricatives are allophones of the voiced stops /bdg/: [bdg] occur in utterance initial position and after certain sonorants; [βɣ] occur in all other positions. Depending on the reference being cited, /tʃ/ is classified with the voiceless stops (Alarcos 1950), with the voiceless fricatives (Stockwell and Bowen 1965) or as the single member of a voiceless affricate class (Dalbour 1969). In this paper, /tʃ/ will be referred to as a member of the voiceless fricative class. The greatest disagreement concerns the classification of /w/ and /j/: (1) as semivowels (Stockwell and Bowen 1965); (2) as fricatives (Dalbour 1969); or (3) in separate classes, the /j/ with /bdg/ as voiced or lax sounds, and [w] as a phonetic non-syllabic variant of /u/ or /gu/ (Alarcos 1950). The two sounds /w/ and /j/ will be referred to as glide consonants in the present paper. The class of sonorants is divided into the nasals /mɲɲ/ and the liquids /lcʀ/. The symbol /c/ represents the apico-alveolar single flap r, and /ʀ/ stands for the apical trill r phoneme. All eighteen consonant phonemes may occur in intervocalic position, and all but two (/c/ and /n/) may appear in initial position; in final position, however, only /nsrld/ may occur. The symbol /r/ for final position represents a neutralization of the two r phonemes, and final /n/ represents a neutralization of all nasal phonemes.

Si was 1;7 at the beginning of the study. During the first month, her spontaneous production was limited to a very small set of words (N=12). The set of consonantal phonemes in her speech was correspondingly small: the voiceless stops [p,t], the nasals [m,n] and the glides [w,j]. Si's phonemes corresponded to the appropriate adult phonemes, with the following additional relationships: /b/ was realized as [p] or [w]; /k/ as [t]; /g/ as [w]; /c,n/ as [j] and /ʃ/ as [n] (in one word, as a result of nasal assimilation). Phonetically, Si's nasals occasionally were de-nasalized and the voiced bilabial stop was sometimes weakened to a glide; a lenis articulation was common to much of Si's production throughout the period studied. By far the greatest phonetic variation was seen in productions of mira 'look' (e.g. [ja], [hi ja], [ʔi ja], [mi ja], [bi ja], [mi a] or [ʔ ja]).

A limited segmental system is typical of the phonology of a young child, and the correspondence between the child's system and that of the adult is typically captured by a set of substitution rules similar to those presented above. In addition, children's productions must be further described by the set of constraints that determine the ways in which consonants can be combined in words of two or more syllables and the constraints that determine the number of syllables which can be produced in any given word. The restriction of words to one or two syllables is probably universal during early acquisition. Consonant harmony--a constraint that stipulates that if two consonants appear in a word, they must be the same or highly similar--is also very widespread and is frequently identified as a universal (Smith 1973; Vihman 1977). Although consonant harmony may be either complete (i.e. involving both place and manner modifications) or partial (i.e. either place or manner), "harmony involving all the features of a segment as opposed to only one or two...is...characteristic of very early speech (Smith 1973)".

In Si's productions, all words were either one or two syllables long, as expected. With regard to consonant harmony, the situation was more complicated. Several words exhibited harmony but were productions of adult Spanish words in which both consonants already agreed either partially or completely: in bebé 'baby', papá 'father' and guau guau 'bow wow', both syllable initial consonants were of the same place of articulation and a highly similar manner. One word--rana 'frog'-- was a clear case of complete harmonization ([na na]). Dame 'give me' was also (partially) harmonized ([pa me]); however, in all subsequent productions of this word, the initial consonant was deleted.

In contrast, manzana 'apple' was not produced with both consonants agreeing in place feature: manzana → [ma na]. The completely harmonized production which could have been expected is [na na], which was the production used by all the other children. In the output form of [nana], a 'weak-syllable deletion' rule could be posited to explain the reduction of

this word from three to two syllables. Such a rule is quite common in early child phonology (Ingram 1974b), and a similar rule ('initial syllable(s) deletion') was characteristic of another subject in the study. In fact, Si used the 'initial syllable(s) deletion' rule several months later. In the beginning stages, however, she deleted the medial syllable of manzana, and in general deleted syllables in a flexible manner consistent with the goal of producing a favored output form. The flexible 'syllable deletion' rule, the absence of complete harmonization, and the use of a favorite two syllable canonical form (in which a word initial labial consonant combined with a medial dental consonant)--as seen in the production of manzana--were to become the typical features of Si's early phonological system.

Niño 'boy' and niña 'girl' were produced with an initial dental nasal and a medial glide (i.e. /p/ → |j|). Here and during all subsequent stages, glides freely combined with other consonants in two syllable words. Evidently the nonconsonantal nature of glides exempted them from the constraints which limited the co-occurrence of consonants. As will be seen, the liquids also combined freely with other consonants during the stages in which they were realized as either glides or liquids.

Thus, Si's phonological system during the month she was 1;7 was limited to labial and dental stops and nasals and the glides. During the first session, she also occasionally babbled long sequences of syllables in which the consonant segment was either [b], [p] or [w]; such babbling did not occur in later sessions. However, during all four sessions of this period and during many sessions in the first several months, Si produced long utterances containing only one recognizable word. In such 'sentences', the 'extra' syllables contained the same consonant as occurred in the recognizable word; thus, these 'sentences' were primarily labial or dental sequences. Si continued with her preference for labial and dental stops and nasals in selecting favorite words, in her nonsense rhyming and in her sound play, all of which drew upon this set of consonants. This set remained at the core of her phonology for several months.

5.0 Si's early phonological development (1;8 to 2;1)

In the preceding section, syllable deletion and consonant harmony were mentioned as major means by which many very young children simplify the phonological form of adult words. Smith 1973 includes these in his list of the four functions of child rules: (a) consonant and/or vowel harmony; (b) consonant cluster reduction; (c) systemic simplification (e.g. the reduction of adult contrasts); and (d) grammatical simplification (e.g. the absence of final s and hence of the singular-plural contrast in English). Clearly, constraints on the length of words, on the complexity of the child's phonological system and on the complexity of combinations of sound in words

operate universally to affect simplification. However, there is ample evidence in recently published papers that demonstrates that individual children may differ in the strategies they adopt which achieve such simplification--a fact recognized explicitly by Smith in a more recent paper (Smith 1975): "...whereas the tendencies or strategies themselves are universal, the rules which implement them...are child specific".

It is also true that in spite of the early and strong necessity to simplify the adult phonology, children must ultimately learn the entire set of phonological units which are contrastive in the language being learned. The 'phoneme' is one such unit that is traditionally recognized in phonological theory and is used frequently as the basic unit in studies of child phonology (Smith 1973). However, recent studies (Ferguson and Farwell 1975; Menn 1971 and 1977; see also Ferguson 1977a) have demonstrated that a more appropriate unit of analysis for the corpora from very young children is the 'word'³. In these studies, phonological rules are not realization rules deriving a child's surface form from an underlying adult phoneme (as in the Smith framework) but, rather, are formalizations of the strategies which a particular child has adopted to represent words and classes of phonetically similar words (see Menn 1976). Si's early development can best be accounted for within a framework that recognizes the significance of early words and word shapes in the development of the young child's phonology and the variability with which individual children implement the simplification processes (Ferguson and Farwell 1975; Farwell 1976).

It will be seen that the use of the 'word' (and 'word patterns')

3. Although Si is chronologically older than the 'young' children reported on by Ferguson and Farwell and Menn, she is more similar to these children with respect to the size of her vocabulary. Ferguson and Farwell use the first fifty words as the time domain for the phenomenon they describe. Si was using a vocabulary of approximately fifty-two words up to the age of 1;10.15 and had ninety-seven words only by the age of 2;2 (n.b. as determined by her productions during our experimental sessions). With respect to age and vocabulary growth, she is similar to the other children in our study. Several factors may be relevant to the chronologically later development of our Spanish-speaking subjects when compared to the English-speaking children in the literature. All but one of our subjects were at least fourth to seventh in sibling order, and all came from lower socio-economic families. In contrast, the English-speaking subjects are typically first-born children of upper or middle class families where one or both parents are college educated. In addition, there may be differences in child-rearing practices between the two cultures which may affect language development. The differences between the two language groups should be interpreted cautiously, because in addition to socio-economic and possibly cultural differences between the two set of subjects, there are also differences between the methodologies of the various experiments.

rather than the adult 'phoneme' (and phonemic contrasts) as the basic organizing unit of Si's early phonology better explains the variation in words over time, the development of canonical forms, the variable correspondence between adult phonemes and Si's phones, and several additional phenomena--the latter of which would be largely inexplicable within a framework like Smith's which maps adult-like underlying representations into the child's surface forms. By the end of this period, however, much of the evidence for a word-based phonology has disappeared, and Si's productions during the period 2;2 to 2;5 can more easily be described in terms of phonemic contrasts and related phonological rules. During the period up to 2;2, Si was also learning contrasts between individual sounds and the equivalences between similar sounds in different environments (i.e. phonemic contrasts and allophonic relationships) and in fact during the period 2;2 to 2;5, her phonetic realizations of adult Spanish phonemes in different positions, environments and words were much more regular. Although the framework of section 6.0--which covers the period 2;2 to 2;5--will accurately reflect Si's transition from words to phonemes, this change is most obvious in the comparison of the end state (2;5) with the beginning one (1;7-1;8); how the transition precisely came about is not nearly so clear, primarily because the two developments overlapped. The learning of word patterns characteristic of the entire period (1;8 to 2;1) will be discussed in section 5.1. The evidence for Si's learning of phonemic contrasts will be presented in section 5.2. Section 6.0 will cover the later period, 2;2 to 2;5.

5.1 The learning of word patterns

Table 1 presents the development of word patterns in two and three syllable words of the form (C)(V)CVCV. These word patterns capture the ways in which constraints on the co-occurrence of consonants in words were gradually relaxed; for this reason, word patterns of the form (V)CV (i.e. words with only one consonant) are not included. The set of consonants included in this table includes stops, nasals, fricatives and liquids; from the beginning stage (1;7), the glides could freely combine with other consonants and hence have been omitted from the table.

In the first column are the word shapes in which both consonants agreed in place. Although in adult Spanish /tʃ/ is a palatal affricate and /tɰns/ are referred to as dental consonants, they are here considered to 'agree' in place because Si's productions of these sounds did not conform to the adult contrast: she usually produced all five consonants as [+alveolar], but her phonetic range covered the entire dimension of dental to palatal. These sounds will be referred to as the class of dental consonants, following the typical nomenclature for the adult phonemes /tɰns/.

Table 1. Development of Word Patterns in Two- and Three- Syllable Words

STAGE	C ₁ [α place]	C ₂ [α place]	C ₁ [+front]		C ₂ [+back]	C ₁ [+back]		C ₂ [+front]	AGE
			C ₁ [+labial]	C ₂ [+dental]	Other	C ₁ [+velar]	C ₂ [+dental]	Other	
I	p/b_p/b_ n_n_	†p_n_		m_n_					1;7
II	m_m_		p/b_t/d_		b_k_			(t_p_t_)	1;8.7
III	k_k_ t/_t/_		p/b_n_ p/b_nt_						1;9
IV	t_t_ t/_t/_	t/_n_	m_s_ f_n_		n_p_				1;10.7
V		t/_l_ t/_nt_	p_l_		b_p_	k_t/d_			1;11.7
VI		† t/_t/_t_	p_n_ p_(n)t_(n) f_nt_ f_t_n_ † p_s_			n_n/t_ k_s_			2;0.7
VII	A. B.	† n_l_ n_t/_ s_n_ t_n_ l_l_ † b_nb_	p_n_ f_t_ m_l_ p_t/_n_ b_s_ f_n_s_ j_b_s_ m_s_ b_j_n			k_l_ † n_f_ k_m_ s_p_t_ † d_k_ s_p_ l_p_s_			2;1
									2;2

NOTES: (1) All word patterns in the table correspond to two syllable productions except the following: t_p_t_ and s_p_t_ for zapato (Stages II and VIIA); t/_t/_t_ for chachita (Stage VI); f_t_n_ for teléfono (Stage VI), and p_t/_n_ for manzana (Stage VIIA). Only one other 3 syllable production occurred during this period: k_v_j_ for caballo (Stage VIIA).

(2) † = only one occurrence of one word.

(3) () = an optionally occurring consonant.

(4) / = either consonant may occur.

(5) L = cover symbol for a liquid which had various phonetic forms.

The most interesting developments in word patterns are seen in columns II and III. Here, it is clear that Si preferred the order of consonants in a word to be [+front] in initial position and [+back] in medial position: all final consonants were deleted until stage VII. Moreover, the preferred initial, front consonant was a labial one and the preferred medial was a dental. This preferred 'front+back' ordering accounts for the output form of all her words from 1;7 to 1;11.15, except the pattern [t_p_t_], which was used only for zapato 'shoe' (stage II). This pattern appears in parentheses in the table, because it was not a productive word pattern (i.e. it was used for no other words nor for the generation of additional word patterns). The early syllable structure accuracy (stage II) of zapato is unusual for two reasons: (1) it was lost during stage III, and (2) no other three syllable productions were regularly produced until stage VI. Two other words, elefante 'elephant' and manzana 'apple' were also produced with a three-syllable form for a brief period before being regularized to a two syllable form (see Moskowitz 1971 and 1973 on phonological idioms).

Up to stage V, all initial consonants in column II class words were labial. During stages V and VI, a pattern emerged which violated the front+back ordering: the new word pattern contained the other member of the [+grave] class (a velar stop) in initial position, with a dental consonant still preferred in the medial position. That the new pattern was not of the form 'dental+velar' is significant and demonstrates that Si's preference was not simply a 'fronting' strategy (see Ingram 1974a on 'fronting' in child phonology).

The data in columns II and III also show that the process by which Si expanded her repertoire of word patterns was one in which new patterns were created out of existing ones. The patterns of [p/b_n_] and [p/b_nt_] of stage III represent a combination of the patterns [m_n_] and [p/b_t/d_] of the earlier two stages. In stages IV through VII, the set of possible initial consonants was expanded to include the remaining labial consonants, while the set of possible medial consonants was expanded to include several additional dental consonants. The creation of new word patterns on analogy with existing ones is seen most clearly in the great expansion during stage VI, when many new words and new word patterns were acquired. In this stage, Si expanded her general 'labial+dental' pattern to include nearly all the possibilities of appropriate consonant co-occurrence. She also overgeneralized [+velar] in initial position to include a velar 'nasal', a sound which has no phonemic status in adult Spanish and occurs in syllable final position only (as an allophone of /n/ before velar consonants).

The use of [ŋ] only occurred for a two week period and was restricted to productions of three words: rana 'frog' ['wa ŋa 'ga ŋə 'ŋa nal]; bola 'ball' → ['ŋaU wə]; and gato 'cat' ['ŋak to 'ŋa ko] (cf. also the child in Ferguson et al. 1973 who adopted [ŋ] as a favorite sound for a

short period of time). The productions for gato occurred only in imitations; Si rarely used this word spontaneously. Gato was produced with either an initial [n] or an initial [k] for a three week period during the following stage and subsequently stabilized with an initial [k]⁴. Prior to stage VI, gato had been produced as [ka ko].

The ways in which Si expanded her repertoire of word patterns by combining and/or expanding existing patterns point to the significant roles which over-generalization and analogy play in the acquisition of phonology (as they do in the acquisition of syntax and semantics). Si's phonemicization of the velar nasal strikingly demonstrates these processes and shows that it is not always the case that the child's phonemes correspond directly to the representations and feature assignments of adult phonology; more importantly, it points to the creativity exhibited by the child in his/her role as the active organizer of phonology. This latter fact has only recently begun to be recognized (cf. Moskowitz 1971); most previous discussions of phonological acquisition assumed the role of the child to be passive. Recent work by Kiparsky and Menn (1977) assigns a significant role to the child's creative role and characterizes phonological acquisition as inherently a cognitive (i.e. problem-solving) task. Clearly this approach fits Si's development well.

Words during these stages fell into several types of patterns and Table 1 demonstrated the regular nature of word pattern development over time. These facts in themselves suggest the importance of words and word patterns to Si's early phonological development. More convincing evidence comes from the flexibility with which several processes operated on individual words to produce the preferred word patterns, several unusual substitutions and the change in form of several words which occurred as new word patterns were learned.

Table 2 presents the first two word patterns learned by Si and shows the ways in which words were processed to fit the output goal. The first column gives the words which were selected to fit particular patterns. The next four columns correspond to four processes--syllable reduction, metathesis, substitution and consonant cluster (CC) reduction--which Si used to simplify adult words. The last column gives a phonetic transcription of the most typical output form; when two forms occurred, both are given.

The word pattern [p/b_t/d_] was much more productive than [m_n_]; however, the same statements can be made for both pattern types, and the general point of interest here--that of the variable nature of the processes--

4. The other subject for whom analysis is complete produced gato with an epenthetic [n] ([kan to]) during a brief period of two weeks, when he was 2;1.

Table 2 Analysis of the first two word patterns acquired by
S1: [m_n] and [p/b_t/d_]

WORD PATTERN	STAGE AND AGE	WORDS	PROCESSES			SAMPLE PRODUCTION		
			Syllable Reduction (deleted portion underlined)	Metathesis	Substitution		CC-reduction	
A. [m_n]	I 1;7	<u>manzana</u> <u>mano</u>	manzana		m→v		mən_nə vəIn_no	
	II 1;8.7	<u>Fernando</u>	Fernando Fernando		[tə] [tə]	nd→n	[mən_nə] [vən_no] [nən_no]	
		<u>Ramon</u> <u>comiendo</u>	Ramon comiendo		m→b-v-m		mən mən'In_nu	
	VII 2;1					nd→n		
B. [p/b_t/d_]	II 1;8.7	<u>pelota</u> <u>pata</u> <u>pato</u> <u>zapato</u> <u>sopa</u> <u>Vicki</u>	pelota zapato 					'p'at_da 'pa t'a pət_da [p'wat_t'o] [b'wad_do] p'vax t'a [b'wit_tI] [b'jlk_ke]
				sopa	o→a (assimilation)			
					k→t			
	III 1;9	<u>elefante</u> <u>librito</u> <u>libro</u>	elefante librito		f→b-p	nt→t		bat_te p'it_də
	IV 1;10.7	<u>vestido</u> <u>perro</u> <u>plato</u>	vestido 	libro	l→d i, o→I r→d	br→b br→b		'b'it_tI b'e'də p'wax t'o
						pl→p		
	VI 2;0.7	<u>bota</u> <u>pastel</u>			l→n-ɸ	st→t		'bə tə [pət_tɛj] [pət_tɛn]
	VII 2;1	<u>reloj</u>			Y→b l→d Y→p-l l→l			} b'ud_də } [h'izl_lo] [pəl_'lo]

- NOTES: (1) The variability in the voicing of stops is not listed under substitutions; see section 5.2 for discussion of the acquisition of the voicing contrast.
(2) Words are listed only under the first stage in which they appeared.

-applies to both equally. The process of syllable reduction operated to delete either the initial syllable(s) or the medial one. The choice of which was deleted depended crucially on the consonants in the syllables. Si's goal was to achieve an output form of 'labial+dental'. If the labial consonant occurred in the correct initial position, then the medial portion of the word was deleted: manzana 'apple', Fernando 'brother's name', pelota 'ball', and vestido 'dress'. If, however, the labial consonant was in medial position in the adult word, the preceding syllables were deleted: Ramón 'brother's name', comiendo 'eating', zapato 'shoe', elefante 'elephant' and librito 'little book'⁵. In the cases in which medial segments were deleted, the situation was more complicated than just the deletion of syllables. The general phonetic quality of the vowels which appeared in the output form suggests that Si was retaining the vowel of the stressed (penultimate) syllable; this vowel was then combined with the word-initial consonant to form the first syllable of the output form (see Menn 1974 on the 'essentially universal preservation of the stressed vowel' in child forms).

In both syllable reduction types, the adult word functioned as a single prosodic unit, the features of which were changed to fit the output goal. All the adult words which were selected by Si to fit her patterns of [m_n_] and [p/b_t/d_] had a labial and a dental consonant somewhere in the word; this requirement is crucial for distinguishing between words which underwent metathesis as opposed to harmony. Metathesis--an uncommon process in child phonology--occurred in Si's speech but not in the speech of another subject--a subject who used (complete) harmony almost exclusively to simplify adult words (Macken 1976a). Si also used (complete) harmony but considerably less than would be expected on the basis of its documentation in the literature. The only words which underwent metathesis were those words which contained labial and dental consonants in the 'wrong' order (e.g. sopa 'soup', Table 2B; and teléfono 'telephone', Table 3B). In contrast, words which exhibited complete harmony were words which had an 'incorrect' ordering of consonants, but lacked one of the pattern criterial consonants (e.g. gato 'cat' [ka ko] stage III). Cases of metathesis and (complete) harmony were not common in Si's data.

Substitution processes also operated in different ways, depending on the consonant structure of the adult word and the needs of Si's patterns. For example in Fernando (which contains a word initial labial and a nasal as the first consonant of the stressed syllable), /f/ → [m], while in elefante,

5. The gloss for this production could be libro 'book', in which case, Si metathesized the consonants to achieve the preferred output (see also sopa 'soup'). This was one of several cases in which an examination of Si's imitated corpus was of no help in solving a problem occurring in the spontaneous corpus: Si's imitations of libro were always closer to the adult form than her spontaneous production. It was clear from the context that when she produced the form [pɪ t/də], she was referring to a book, but whether the origin of her form was libro or librito could not be determined.

/f/ → [b/p] (Table 2). In perro 'dog', /ʔ/ → [d], while in reloj 'watch', /ʔ/ → [b] (Table 2). Further examples of substitutions being determined by word patterns will be seen in Table 3. In contrast to the goal-directed and, hence, variable nature of the processes of syllable reduction, metathesis and substitution, consonant cluster reduction--the fourth process needed to explain surface forms--was very systematic: nasals were deleted when followed by a voiceless stop; voiced stops were deleted when followed by a nasal; liquids were deleted in all clusters; and fricatives were deleted when followed by a stop (Table 2).

Table 3 contains eleven words and charts their development through stages I to VII. Most of these words demonstrate unusual correspondences between adult phonemes and the phones in Si's productions. Several of these unusual substitutions have already been mentioned. Throughout this period of 1;7 to 2;1, /t/ → [p/b] only in tenedor 'fork' (Table 3B), /m/ → [p/b] systematically only in manzana 'apple' (Table 3A) and Ramón 'brother's name', and /ʔ/ → [p/b] in initial position but → [l] in intervocalic position (reloj versus perro, Table 3B). The first three fricative words which Si acquired were also unusual: /f/ → [tʃ] in Fernando 'brother's name' and elefante 'elephant'; and /s/ → [f] in manzana 'apple'. Although the phonetic realization of /f/ in Fernando and elefante was [tʃ] (phonetically very similar to the adult phoneme /tʃ/), it is possible that the source of the substitution error was a confusion of /f/ and /s/. In contrast to these three words, all subsequently acquired words were realized with correct /f, s, tʃ/ contrasts.

With the exception of the words involved in the /f/ and /s/ reversal, all the unusual substitutions can be accounted for by the overgeneralization of Si's preferred word patterns, although this 'pattern force' in itself cannot explain why these particular words were susceptible and not others (see Labov et al. 1972 on the riddle of actualization). As will be seen, prosodic similarity between certain adult words provides a plausible explanation for the similar treatment of some words.

Table 3A shows the developmental changes in six words. At stage III, manzana 'apple' changed from [manal] to [p/banal], due to the overgeneralization of the [p/b_n_] word pattern; at stage IV, it changed to [fanal]. This latter change is consistent with Si's tendency to combine features from different segments of the adult word: the labiality of the initial /m/ and the frication and voicelessness of the medial (stressed syllable) /s/. The odd development occurs in elefante 'elephant', which had been [pantel] during stage IV but changed to [tʃantel] during stage V; the expected development would have been [fante]. Two possible explanations can be offered: words as prosodic units; and confusion between adult fricatives.

Table 3. Acquisition of Word Patterns as Shown in Developmental Stages of Selected Words

STAGES AND CORRESPONDING WORD PATTERNS ACQUIRED						
I	II	III	IV	V	VI	VII
[u_n_]	[b_d_] [p_t_]	[p/b_n_] [p/b_nt_]	[t/ t/] [t/ n_] [f_n_] [n_s_]	[p_l_]	[p_n_] [p_(n)t_(n)] [f_nt_] [f_t_n_]	[p_n_] [f_t_]
A. <u>manzana</u>	mô na	(bwan_ne) (pwan_nô) (man_na)	fun_ne	(pan_na) (fan_n) (an_na)	(pan_na) (t/an_na)	(t/w_n_na) (pôç 't/an_na)
<u>elefante</u>		(ba re) (pan_tI)	pwan_tI	(bwan_te) (t/an_te)	(ban_te) (t/an_te) (fan_te)	(ban_te) (fan_te) (tad_tI)
<u>cuchara</u>			(t/an_na) (t/ad_dô)			(t/an_nô) (a la)
<u>Fernando</u>	(man_no) (wan_no) (nan_no)	(na no) (jan_to)		(man tu_(I)) (me 'an_dô)	tçI 'nal to_(I)	
<u>teléfono</u>					(tçn ton_no) (fwa tîn_nû)	'twe fân_no
B. <u>rana</u>	na na	(wan_na) (an_na)			(nan_na) (man_na) (wan_na) (bwan_na) (gan ke) (nan_na) (nan k'e)	(nan_na) (tan_ne)
<u>reloj</u>	SwI Ip_(I)	nen no_(I)		haU doU		(bûd 'do) (SwIn_no) (hîwî_lo) (tôj_ô) (ne o) (pâl 'lo_(I))
<u>raton</u>			(pe lan)	tçn_(I)	pûn 'tçn	pûd_nô
<u>tencdor</u>				bô'd_dô_(I)	pçn_nûn	pûn 'tç:
<u>pastel</u>					(pât 'tç) (pât 'tçn)	(pî 'tç-ê) (pî 'tç)
<u>perro</u>		(p'e lo)	bc' dô pe lo	'p' o		'pe dô 'pç'd dô

NOTES: (1) Variable forms are listed in order of frequency.

(2) [] = variable forms, given when a stage was characterized by significant variation.

(3) () = questionable referent.

(4) —→ = word form remains unchanged throughout period indicated by arrow.

(5) Subscript (I) following a form indicates that it occurred in imitation only; imitated forms are given only if they differed significantly from the spontaneous form.

(6) Two sets of variable forms are given for rana; those contained in the second group occurred only during the last two weeks of Stage VI.

In the 'words as prosodic units' explanation, two factors may be relevant: I. within-word combination of features from different segments; and II. cross-word 'prosodic' similarity. I. First in manzana, the combination of features [+labial] and [+fricative] resulted in [f]; in elefante, it may be that the change of /f/ to [tʃ] was a result of the influence of the [+dental] feature of /l/, although such an interaction would be anomalous in Si's treatment of liquid words. II. Note that in the preceding stage (IV), cuchara 'spoon' was usually produced as [tʃa na]; cuchara also contains a dental liquid in the adult form. To Si, perhaps, the prosodic similarity of cuchara and elefante was greater than that between manzana and elefante, which would account for the same pattern having been adopted for elefante. Similarly, Fernando was either [ma no] or [na no] during stage II. Here two processes were in competition. In [ma no], the preference for a labial consonant in initial position resulted in the feature combination of labiality of initial /f/ and the nasality of the (stressed syllable) /n/ to produce [m]. In [na no], the initial unstressed syllable was deleted. In both, the cluster was reduced. During stage VI, Fernando was added to the prosodic class to which elefante and cuchara belonged, a change which resulted in the new form [tʃl 'nal to]. Throughout this period, Si regularly produced an initial [tʃ] in imitations of this word. It was common throughout this period for old words to change as new word patterns were acquired--a phenomenon which presumably was due to changes in Si's hypotheses about which words and sounds were similar and should be said in similar ways.

The alternative explanation would be that Si simply confused /f, s, tʃ/. However, the production of [f] for /s/ in manzana is consistent with Si's general tendency to combine features from segments of the adult word, and the production of [tʃ] for /f/ in elefante and Fernando is consistent with Si's general tendency to overgeneralize word patterns to new instances of words which were prosodically similar in some way. If Si confused these fricatives, she apparently did so only in these three words: all subsequently acquired words containing /f, s, tʃ/ were produced correctly, and some of these words were acquired during the same time period that the three words showed the reversal.

Neither of these explanations--'words as prosodic units' or 'fricative confusion'--is necessarily correct, or they both might be. The 'word as prosodic unit' though does seem to be a factor in Si's treatment of tenedor 'fork'. In Table 3B, rana 'frog', reloj 'watch' and ratón 'mouse' show how Si selected initial /r/ words (which also had a medial dental consonant) to be members of the [p/b_t/d_] word pattern class. A possible explanation for why tenedor was also selected to be a member of this class is that the final /r/ (of the stressed syllable) made this word prosodically similar to the class of initial /r/ words, in which case the labiality of the /r/ (phonemically [b] in initial position for Si) combined with the voicelessness of the initial /t/ to result in the output [p].

The force exerted by preferred word patterns provides a plausible explanation for the otherwise inexplicable treatment of many adult words and phonemes. However, the same 'pattern force' which frequently caused words to change phonological form also caused variation which was not so easily interpreted. The variation seen in Table 3B for rana was typical of many words and also points to the problem of knowing whether an output change was due to the phonological reorganization of a word (as in the overgeneralization of a newly acquired pattern seen in manzana, stage III, Table 3A) or whether it was due to a phonetic 'slip-of-the-tongue'. In Fromkin's theory (1973), slips-of-the-tongue are not random errors made in speech production but are rule-governed errors, which systematically reveal the nature of the rules of the grammar. Although Fromkin's theory of speech errors has not been discussed in the literature on child phonology, it provides a good explanation for some of the variation seen in Si's productions of words. In rana, for example, the earliest and most commonly produced form was [na na]. The variation seen in other productions for this word could be explained as 'slips', the nature of which was determined by the rules of Si's grammar (i.e. the force of word patterns). During stage IV when the pattern of [tʃ_n_] was established, rana was imitated a few times as [tʃa na]. Its variant form [pwa na] during stage VI could either be a phonological reorganization (patterned after ratón) or a phonetic slip in the direction of a close and 'strong' pattern. In either interpretation, the production results in a form which is consistent with other aspects of her phonology. A similar argument concerning the variation seen in reloj can be made.

The variation seen in the words presented in Table 3 is in many ways characteristic of Si's productions for particular words, and this variation had many causes. As previously mentioned, some variation was due to the phonological reorganization of old words as new word patterns were learned; similarly, the variation of a word during a single time period was often due to the overlap of stages of development. It has also been suggested that the infrequently occurring forms of some words--variable forms which nonetheless exhibited some regular pattern--can be attributed to the force of the word patterns (i.e. rule-governed slips-of-the-tongue). All the causes of variation discussed in this section resulted in phonologically revealing productions; in section 4.0, randomly occurring phonetic variation was mentioned and related to Si's typically lenis production. One other type of variation was seen in a few words during the earliest months of the study; this was variation which apparently stemmed from Si's experimentation as she searched for an 'acceptable' way to produce a particular word. The most striking example of this experimentation was in Si's productions of elefante prior to the point at which it stabilized as [ba tel] (Table 3B, stage III): ['hwan tu ti], [pʃan tɪn di], [pan ti], ['ban tɪn di] (early stage III). Its subsequent variation--i.e. between [bá tel] and [p/ban tel]--was due to the overlap of two stages, only the earlier one of which was characterized by obligatory cluster reduction.

In summary, the evidence for the primacy of word patterns as the organizing principle of Si's early phonological development has been the following: (1) all words had a consistent word pattern form; (2) the gradual development of classes of word patterns can be best described as a process by which new patterns resulted from the expansion of previously acquired word patterns; (3) some words changed pattern over time as new word patterns were learned; (4) three of the four simplification processes operated to produce favored word patterns as output; and (5) several unusual phonological substitutions and some phonetic 'slips' can only be explained by the notion of 'pattern force'. It will be seen (section 6.0) that 'errors' during the late stage of acquisition were usually the frozen forms of earlier word patterns, which proved to be particularly resistant to change (cf. 'regressive idioms', Moskowitz 1971 and 1973)

5.2 The learning of phonemic contrasts

As significant as Si's word patterns are, there is evidence throughout this period that Si was also learning the phonemic contrasts of Spanish. This evidence is of two types: (1) the close correspondence between Si's word patterns and the consonant structure of words which were selected as members of each pattern class (which shows both an early ability to segment adult words and an early recognition of differences between the major places of articulation); and (2) the close correspondence between some of Si's phonemes (as determined by different sets of phones) and the phonemes of adult Spanish.

From the very beginning, the close correspondence between the labial-dental place contrasts of Si's patterns and the place contrasts of the adult words which comprised each pattern class demonstrates Si's recognition of the differences between these places of articulation--a necessary precursor to phonemic learning. The velar-dental contrast in stops--which was merged during stage I (/k/ → |t|)--was recognized by Si during stage II and was established by stage III in all words except gato 'cat'. Gato, which was subject to the early ordering constraints, persisted as [ka ko] until stage VII, at which time it was produced either as [ka to] or as [d/ta ko]. The latter form contradicts the metathesis rule of the early stages and was the only example of metathesis involving a velar+dental sequence in the entire corpus.

In addition to the separation of places of articulations, Si's stage I productions showed a phonemically relevant distinction between manners of articulation--nasal/oral. The resulting four-way contrast of labial/dental and nasal/oral produced the four consonantal phonemes |ptmn|. These are listed with the glides as the phonemic inventory for stage I in

Table 4, which lists the order in which consonants achieved phonemic status during stages I through VII.

During stage I, voicing was not distinctive, nor was the contrast between the dental and palatal nasals (/p/ → |n|); section 4.0 discussed all aspects of the neutralization of adult contrasts seen in the substitutions of stage I. During stages II to VII, Si began to distinguish the voiced/voiceless contrast in at least the labial stops, acquired the palatal nasal, the stop/fricative contrast and a three way contrast within the voiceless fricative class, and achieved a rudimentary two way contrast within the liquid class (Table 4).

Within the stop class, a three-way place contrast was accomplished by stages II/III; the acquisition of the voicing distinction was more complicated. Throughout stages I to VII, /b/ was usually produced as [w]; in the infrequent cases where it was produced as a stop, it typically was voiced. The phoneme /p/ was usually voiced during stage I (although the number of tokens was small) and was either voiced (28 tokens) or voiceless (20 tokens) during stage II; from stage III to stage VII, it was rarely voiced. Further evidence of Si's contrast between /b/ and /p/ can be seen in substitution patterns: /b/ → [b, β, w], rarely [p] and [ŋ] in bola 'ball'; /p/ → [p, b], once [v], and never [w]. The [ŋ] which occurred for /b/ in bola was analyzed as having separate phonemic status. The adult contrast between /t:d/ and /k:g/ was absent. Of the dental pair, words containing /d/ were very rare, and the /d/ was deleted in four out of the total five productions of /d/-words. The phonetic variability of /t/ was very similar to that for /p/: usually voiced in stage I; either voiced (29 tokens) or voiceless (18 tokens) during stage II; and almost always voiceless during stages III-VII ([t], 45 tokens versus [d] 4 tokens). The allophones of |t| were [t, d] and [k] (in gato, as a result of velar assimilation). Tenedor was produced consistently with an initial segment [p] which was analyzed as being phonemically unrelated to |t| (section 5.1). The adult phoneme /g/ was as rare as /d/; it occurred only in gato (where Si treated it as [k]) and in guau guau (where the initial /g/ was phonemically |b| in Si's system). On the basis of the differences between Si's productions of /b/ and /p/, it can be argued that Si had a phonemic contrast of voicing in labial stops by stage III; she however had not fully mastered the phonetic control of voicing. Si's dental and velar stops were phonemically and phonetically voiceless. The Spanish phonemes /bdg/ also have voiced fricative allophones in medial position; since Si had no voiced velar and dental stops, it would be reasonable to expect an absence of [ð] and [ɣ], which in fact was the case. In the two words--guau guau 'bow wow' and agua 'water'--where [ɣ] could be expected, Si regularly produced [w] (although the glide was often produced with some velar friction). For the initial segment of guau guau, Si usually produced [b], which is the adult initial phone in this word in Spanish baby-talk. The fricative allophone of /b/ began to be produced in stage IV, but it just as often occurred in initial position as in medial position; Si gave

Table 4. Acquisition of Consonant Phonemes

	NON-FINAL POSITION					FINAL POSITION	
	Stops	Nasals	Glides	Fricatives	Liquids	Medial Consonant Clusters Only	
I	pt	mn	wj				1;7
II	k					(n)	1;8.7
III	b			tʃ	l	nt	1;9
IV		n		s (f)			1;10.7
V					(r)*	(s)	1;11.7
VI		ʈŋ		f		n	2;0.7
VII						(mb) (l)	2;1

NOTES: (1) () = 1st appearance.

(2) † = drop out after two weeks

(3) * = phonemically distinct but phonetically not adult-like.

no evidence of having the complementary distribution relationship between /b/ and [β].

The nasals /m/ and /n/ were phonemic in Si's system from the beginning, and at least /n/ was phonetically stable throughout stages I through VII. The labial nasal however was occasionally denasalized: [m] → [m̥], occasionally [w] (3 tokens), regularly [p] in manzana, and [m̥, βw, or w] in Ramón. These latter substitutions (in manzana and Ramón) were discussed in section 5.1 as the outcome of pattern regularization: at stage II, when manzana changed from [ma na] to [pa na], the word is assumed to have been phonologically reorganized and the initial segment is analyzed as [p]; in Ramón, two phonological forms are in competition--[mon] (due to initial syllable deletion) and [bon] (due to medial syllable reduction). The palatal nasal was merged with /n/ during stages I to III; during stage IV, it was distinguished from /n/ ([ɲ] → [ɲ̥, j, n]), a pattern of phonetic variation typical of stages IV to VII. During stage VI, Si used [ɲ̥], a sound which is not phonemic in adult Spanish (section 5.1).

When fricatives were first being produced (stages IV-V), /f/ and /s/ were phonetically interchanged in the words manzana and elefante. As with the [ɲ] in bola, the [p] in tenedor, the [p] in manzana (stage III) and the [βw] in Ramón, the phonemic interpretation of [f] in manzana and [tʃ] in elefante could be handled in various ways, as for example by positing underlying adult phonemes. However, as in the other cases, the less abstract solution was adopted: the surface form was assumed to be the phonemic one ([f] in manzana; [tʃ] in elefante).

All subsequently acquired /f/ and /s/ words were correctly produced, and the different patterns of variation for the phonemes /f, s, tʃ/ argue for their phonemic status in Si's system at least by stage VI. The phonetic control over voicing was not a problem from stage III for [tʃ] and from stage IV for [s] and [f], stages at which the adult phonemes were first realized as fricatives in Si's words: [tʃ] was voiceless 29 out of 32 times; [f] was voiceless 20 times (of which 6 occurrences were in manzana) and was produced as [w] 3 times; [s] was always voiceless ([tʃ] 21 tokens, [f] 3 tokens, [s] 21 tokens, [ç, ʃ] 6 tokens, [ts] once and [h] 4 tokens). However, during the stages when /f/ and /s/ were realized as stops (primarily during stages II and III), voicing was variable: /f/ was a voiced labiodental stop 12 out of 18 times, and /s/ was a voiced alveolar stop 23 out of 32 times. Although [s]-- which of the three fricatives showed the greatest phonetic variation--was frequently [tʃ], the adult phonemes /tʃ/ and /s/ were distinct for Si: /tʃ/ was never produced as [s]. In spite of the fact that the majority (14 out of 21) of the instances in which [s] was produced as [tʃ] occurred in productions of manzana, it is likely that this was due to the high frequency of manzana among Si's /s/ words, rather than to any confusion of /s/ and /tʃ/. Words containing the velar fricative /x/ were not common: /x/ was deleted in both conejo 'rabbit' and in reloj 'watch'.

The class of liquids showed the greatest variation during the stages I through VII. The lateral was the first liquid acquired both phonetically and phonemically. It first appeared during stage III in bola 'ball', but was regularly deleted in three other words. From stages III through VI, it was produced only twice. During stage VII--the first stage at which it was produced with any regularity--, it was realized as [l,j] in intervocalic position and as [n,l] in initial and final position. It was produced as [d] only in productions of reloj where the initial /r/ was produced as a [b] (see the discussion of pattern force and slips-of-the-tongue in section 5.1). The /c/ was completely merged with [l]: it occurred in two words where it was produced as [n,l]. In mira 'look', however, /c/ was regularly produced as [j] (see section 4.0 on the exceptional nature of this word). The /r/ phoneme was similarly merged with [l] from stages I through IV: /r/ → [l,n] (and one time each as [w, d, j], substitutions which may argue for a preliminary contrast between /l/ and /r/). During stage V, Si's productions for /r/ changed: /r/ → [l,d,dj] in intervocalic position (occasionally as [n]). However, in initial position, /r/ → [p] in ratón and to [b,θ,l] in reloj. In rana 'frog', the /r/ was either [n] or a labial consonant [m,w,βw]; during a two week period during stage VI, it was a velar nasal (section 5.1). Clearly the phonetic variation seen in initial position /r/ does not warrant the assignment of phonemic status, and it was analyzed as [bl]. In this analysis, the [p] in ratón was due to voicing agreement with the intervocalic [t]. In reloj, the initial [l] phone only occurred when the medial [l] was produced as [l]; both consonants then agreed due to lateral assimilation. In rana (a word acquired before the labial+dental word pattern was established), the predominant initial phone was [n]; the phonemic status could be either [n] or [bl] (if [bl], then instances of the nasal phone would be due to nasal assimilation). In fact, the earlier form [na na] occurred during the stages in which /r/ was merged with [l]; rana was subsequently phonologically reorganized with an initial [bl], and the two forms competed. In medial position, the differences between the phones that were realizations of /r/ (at least by stage V) and those that were realizations of /l/ demonstrate that Si had at least made a rudimentary two-way phonemic distinction (in medial position only) within liquids: [l] (←/l,c/) versus [r].

Medial consonant clusters and final consonants are included in Table 4 only for convenience; they are not considered to be separate phonemes. The cluster /nt/ was the first cluster to be acquired. In final position, /n/ was acquired during stage II and /s/ during stage V. However both these final consonants were found in only one word each. They were not produced regularly until stage VI for /n/ and stage VII for /s/. A third consonant /l/ appeared in final position during stage VII, but was restricted to only one word and was not consistently produced.

In this section, the acquisition of Si's phonemic contrasts has been described. The correspondences between adult Spanish phonemes and Si's

phonemes can for the most part be explained by the following processes: (1) deletion; (2) phonemic merger; (3) voicing instability; (4) weakening; (5) strengthening; (6) nasalization; and (7) place instability. In addition, the productions of some words were lexical exceptions to general rules. However, several of Si's productions presented formidable problems to a strict phonemic analysis. The unusual nature of the correspondences between the phones in these productions and the phonemes in the adult words can, however, be explained through the recognition of the ways in which Si's output was determined by existing word patterns and Si's tendency to combine features from different segments in the adult words. The explanation for why certain words were given the same output patterns seems to lie in some general prosodic similarity of the words involved (a phenomenon perhaps similar to the prosodic schemas reported in Waterson 1971). The changes over time in output pattern for some words often were due to changes in Si's hypotheses about which words were similar and should be said in similar ways. The unusual correspondences--often the result of feature combinations--and the changes in words incurred as a result of pattern force made a traditional phonemic analysis of words such as manzana, elefante, rana, ratón and tenedor quite difficult and decisions regarding phonemic structure somewhat arbitrary. It is the contention of this paper that the analysis of Si's early data which recognizes word patterns and the prosodic treatment of words (section 5.1) can both describe the development of the consonant structure of words and also account for the unusual segmental correspondences, while at the same time capturing significant facts such as the frequency of word types and phonemes-in-certain-positions, better than an analysis which assumes phonemes to be the basic organizing units of the child's early development.

6.0 Si's development from 2;2 to 2;5

During the period from 2;2 to 2;5, Si's phonological system improved greatly. Her set of phonemes expanded to include nearly all the phonemes of adult Spanish. Although each of her phonemes had several variants, her phonetic control was much improved and the unusual substitution patterns characteristic of the earlier period largely disappeared. The constraints on the co-occurrence of consonants which had previously been a function of the word pattern goals also disappeared; the only exceptions were frozen forms from the earlier period. In terms of syllable structure, most two-syllable and many three- and four-syllable words were produced accurately. Those longer words which did not have the correct syllable structure were reduced by means of a single set of rules: initial syllable deletion; consonant cluster reduction, and an optional final consonant deletion rule. These rules applied to all words, irrespective of the overall consonant structure of the word; this systematicity is in sharp contrast to the variability seen in earlier syllable deletion processes. As in the case of rules governing segments and the co-occurrence of consonants, the only exceptions to the new syllable structure rules were words which were frozen forms from the earlier period.

6.1 Segmental system

By the end of the earlier period, Si's segmental system included phonemes equivalent to all but four of the adult Spanish consonantal phonemes. In initial and post-consonantal position, /d/ was merged with /t/ and /g/ with /k/. In medial position, the voiced fricative allophone of /d/ was treated either as /t/ or as a member of Si's liquid class, while the voiced fricative allophone of /g/ was phonemically /w/. Two other phonemes were absent in Si's system as of 2;1: /x/ which was deleted and /ɲ/ which was merged with /l/. By 2;5, Si's productions showed some evidence for the contrastive status of each of these four adult phonemes, although as with most of her other phonemes, the phonetic realization was variable. The allophonic distribution of the voiced stops and voiced fricatives was not established.

Phonetically, voicing was still not completely mastered. The stop phonemes /p b t d/ occasionally showed voicing errors; /g/ was often devoiced, while /k/ was never voiced. Among the fricatives, /f/ and /s/ were occasionally voiced, and both exhibited a large amount of manner variation: /f/ → [f, fw, w, βw, pw, b, v, pf, w]; and /s/ → [s, ʃ, ç, ç, h, ʒ, tʃ, t, dʒ, dʃ, θ]. In contrast, both /tʃ/ and /x/ were phonetically relatively stable: /tʃ/ → [tʃ], rarely [t, d]; and /x/ → [x, h, θ] and [χ] only in jugo 'juice'. In the English words shoes and home, Si used [tʃ] and [h] respectively. The nasals were phonetically very accurate, although the palatal nasal continued to be occasionally produced as a non-nasal glide. The liquids were by far the least stable phonetically, and in the case of the two r phonemes bore little resemblance to the adult articulations: /l/ → [l, n, θ] rarely [d]; /r/ → [l, j, d, ʒ, θ]; and /ɾ/ → [ɹ, l, n, d]. The fricative [ð], the intervocalic allophone of /d/, was usually produced as [d], but occasionally as [l, n]; thus, its set of phones was identical to the set of phones for /l/. Since initial position /d/ was never produced as [l] and the relative proportions of [d] and [l] phones for [ð] and /l/ differed significantly, Si at least contrasted /d/ and /l/ and in most cases, correctly treated [ð] as phonemically related to /d/. The infrequent cases of [ð] → [l] appear to be the last traces of her earlier indecision regarding the phonemic status of adult [ð] (1;7 to 2;1).

The most significant aspect of Si's phonemic system during 2;2 to 2;5 is that all the unusual substitutions--which were characteristic of the earlier time period--had disappeared: no new words were produced in ways consistent with the earlier pattern dominated substitution rules, and most old words were produced in a manner consistent with the above description of phonemes and allophones. Only five words persisted in the earlier word pattern form:

vestido, /#b/ → [p]; la niña/o, /#l/ → [n]⁶; guau guau, /#g/ → [b]; Fernando, /#f/ → [tʃ]; and tenedor → [bə 'dʌʃ].

6.2 Co-occurrence of consonants

During the period 1;7 to 2;1, the co-occurrence and ordering of consonants in a word were determined by word patterns, primarily the patterns labial+dental and velar+dental. In a small number of words, Si used metathesis as a way to achieve the preferred ordering of consonants. During 2;2 to 2;5, all sequences of consonants occurred, although there were still few words in which the order was dental+labial (in the adult model). In only one word did Si metathesize the consonants; this word was gato 'cat' which already had appeared as [d/ta ko] in the last stage of the earlier period and remained in this form throughout the study. All other words preserved the adult ordering of consonants.

In initial and medial positions, singleton consonants were produced according to the description of Si's phonemes and allophones in the preceding section. In final position, /n/ and /s/ were well established (although /s/ was occasionally deleted), /l/ was usually deleted but occasionally produced correctly, and some allophone of final /r/ ([ɹ, d], rarely [n]) was usually produced; Si used no words containing a final /d/. In addition, Si usually correctly pronounced /m#/ in the English word home; in a few tokens the /m/ was deleted.

In clusters, /s/ and all liquids were deleted, with the exception of one production of éste 'this' ['es ti] (2;5), and two productions of manzana 'apple' [mə 'sa na] (manzana was usually produced as ['sa na]). The nasal+stop clusters /mb/, /nt/, /nd/ and /nk/ ([ŋk]) were well established; if one member of the cluster was deleted, it typically was the nasal in nasal+voiceless stop clusters and the stop in nasal+voiced stop clusters (cf. also Ferguson 1977b). The cluster /ng/ ([ŋ]) was nearly always produced as [ŋk], rarely as [ŋ], once as [ŋ] and once as [k]. Si used no words with the cluster /mp/. The rules governing consonant occurrence in clusters and final position were similar in the earlier and later periods.

6. At about 1;9, Si began producing niña 'girl' as [na 'ni na] (later, the palatal nasal was correctly produced); the adult form of la niña 'the girl' was evidently lexicalized as a unit. Niño 'boy' was also produced with an initial extra syllable [na]. Since Si often neutralized final vowels, it was frequently not clear what gender was intended; she would, however, produce [nə 'ni nə] in imitation of either niña or niño. This word [na 'ni na/o] was very common and was regularly produced with three syllables. No other word was lexicalized with the article into one unit in this way.

6.3 Syllable structure

As was seen in section 5.0, the variable nature of syllable deletion rules provided some of the clearest evidence for the existence of favored word patterns during the early period of 1;7 to 2;1 (Table 2). In the later period, however, Si had two regular rules for reducing three- and four-syllable words to a shorter form: delete the initial syllable(s), or delete the initial or final consonants. Of the approximately seventy words which she acquired between 2;2 and 2;5, only one was reduced in a manner consistent with the earlier word pattern stage: pantalón 'trousers' → [pa 'lon] or [bum po 'lon]. In addition, many words were produced with the correct number of syllables. Only one word persisted in the form from the earlier word pattern stage: tenedor 'fork' → [bə 'dɔɹ]; this word was produced frequently and in always the same form.

To summarize, Si's productions from 2;2 to 2;5 were largely accurate realizations of the complex consonant and syllable structure of the words she knew. Little evidence remained of the earlier stage where the realization of consonants and syllables was constrained by a small number of word patterns. It is worth noting that had Si only been seen beginning when she was 2;2 (or as early as 1;11), the phonological forms of words such as tenedor, vestido, reloj, or pantalón would have appeared anomalous; it is only within the context of Si's earliest development that such words can be seen as an integral part of her developing phonological system.

7.0 Discussion

In the past ten or so years, interest in child phonology has greatly increased among linguists, largely as a result of the incorporation of child phonology data into the class of behavior for which a model of phonology must provide explanations. As a result, many linguistic studies have appeared recently which document the acquisition process for individual children and thus have contributed to the description of phonology acquisition in general. Since phonological acquisition has not been studied sufficiently to separate developmental phenomena reliably from those phenomena that reveal universal properties of phonological structure, it is premature to make claims on the contributions of phonology acquisition to general phonological theory. It is, however, appropriate to ask what the study of an individual child--in this case, Si--may contribute to what we know or hypothesize to be true of phonological acquisition. Towards this goal, aspects of Si's data will be reviewed in this section as they pertain to a general model of phonology acquisition, universals of acquisition and individual differences. It is of course obvious that the validity of the following interpretation can only be substantiated (or invalidated) on the

basis of additional studies of many more children acquiring a variety of languages.

7.1 On a model of phonology acquisition

Several recent papers have argued that acquiring phonology is basically a cognitive process--i.e. a problem solving task (see in particular Kiparsky and Menn 1977). At several points in the preceding sections, data were interpreted as being best explained by such a model. Probably the most dramatic evidence in these data of the child as the active organizer of phonology is Si's phonemicization of the velar nasal, a phonetic segment which occurs in highly restricted environments in adult Spanish but has no phonemic status. The theme of the child's active role in acquisition will also figure prominently in the following discussion of the units of acquisition. However, it will be in the evaluation of individual differences (7.3) that the problem-solving model will be of the greatest relevance.

Of central importance for any model of child phonology is the characterization of the units of acquisition. During the earliest stages (from 1;7 to 2;1), Si's data showed several phenomena which could be best accounted for by assuming a central role for the 'word' as a basic unit being acquired. More specifically, the data argue for several levels of representation in her phonological system. These levels correspond to two and possible three basic units: the word, the phoneme (i.e. some segmental unit larger than the feature), and possibly the feature.

By 'word' is meant a grammatical unit: in these data the word is the morpheme and the morpheme is the word. A grammatical unit was needed to describe the constraints on sequences of smaller units (which are best characterized as phonemes) and to specify the domain within which phonological processes operated (e.g. the simplification process of consonant harmony). In addition, word boundaries were needed to block processes (with the exception of early sentences which were characterized by harmony across word boundaries, section 4.0) and to condition processes (e.g. word-initial versus word-final (but not necessarily syllable-final) phenomena). Some such grammatical unit though is frequently used in just these ways in descriptions of adult phonologies.

However, the data support an even stronger claim regarding the 'word', namely that the word and associated word structure constraints are psychologically real. The evidence for this claim is that Si formulated hypotheses about the nature of Spanish phonology on the basis of the similarity between words, that she abstracted what were referred to here as

'word patterns', that she expanded and generalized these word patterns to handle new words and that she changed the output form of some old words as she learned new word patterns (i.e. words that were similar in some ways underwent rules together). The claim is then that the word was a basic organizing unit of her (early) phonological development and that without the word as a unit, some phonological phenomena would have appeared to have been quite arbitrary and the frequency and consistency of other phonological phenomena could not have easily been explained.

Although the learning of words and word patterns, phonemes and features was occurring simultaneously throughout this period of 1;7 to 2;5, the evidence for the centrality of words and word patterns had largely disappeared by 2;1. In fact, the data from 2;2 to 2;5 could be adequately described in terms of phonemic contrasts, allophonic relationships and phonotactic constraints. This change suggests that the levels of representation constitute a hierarchy--at least developmentally--in which words and word patterns dominate phonemes, and phonemes in turn are more central than features. That the 'phoneme' is a basic building block of the acquisition process can be seen in section 6.0; the evidence for the feature is considerably weaker. Although, it is clear that Si could analyze phonemes into component features (as seen for example in the way in which she recombined features from different segments of the adult word), there is little evidence that once having mastered particular features, she could generalize this knowledge to the acquisition of a new phoneme. For example, the 'acquisition' of the features voicelessness and frication (/f, s/) and velarity (/k/) were not sufficient for the acquisition of /x/ (cf. also Ferguson 1977b). The strongest evidence for the status of the feature as a unit is the overgeneralization of the +velar feature in initial position (word pattern) which resulted in the phonemicization of an initial velar nasal--a process which clearly involved the analysis and generalization of features.

Such a developmental hierarchy would be consistent with the even stronger claims regarding the word made by researchers who have studied children somewhat younger than Si (Cruttenden 1971; Ferguson and Farwell 1975; and Menn 1971 and 1977; see also Ferguson 1977a). The change in the hierarchy seen at roughly 2;2 (but probably occurring earlier) would be consistent with the Piagetian claim that at each successive period of development in the acquisition of complex systems, previous skills are reorganized into a new system of knowledge (Piaget 1952; see also Bower 1974 for a similar view of motor skills). This knowledge of word structure constraints is not lost, and in fact must be substantially elaborated, for it is part of an adult speaker's knowledge of his/her language (cf. Greenberg and Jenkins 1964).

7.2 On universals of acquisition

Clearly, a model of phonological acquisition should also describe the universal aspects of acquisition. In sections 3.0 through 6.0, aspects of Si's development which correlated with putative universals as claimed by various researchers in child phonology were noted. Here, some of those aspects will be reviewed, in order to place them within the context of phonology acquisition in general.

One of the most significant aspects of child phonology is the simplification of adult words to one or two syllables, typically composed of alternating singleton consonants and vowels. Constraints on the length of words, and on the complexity of co-occurrence of sounds in words are probably universal. Smith's four functions of child rules (1973) describe the major types of simplification (see also Ingram 1974b), and these are seen in Si's data as well (section 5.0).

Of the theories which deal with the universal order in which consonants are acquired, Jakobson 1941/1968 is the most explicit. Although there are problems with this theory (see Ferguson and Garnica 1975), the general claims made regarding the order of acquisition of classes of consonants fit the general pattern seen in Si's data and in several other studies of Spanish acquisition (Macken 1975 and 1976a). Si acquired the classes of stops and nasals before the class of fricatives, and liquids were acquired last. Front consonants were acquired before back ones, and voiceless before voiced. /l/ was the first liquid acquired, with the contrast between the r-phonemes acquired considerably later. However, /tʃ/ was acquired before the first true fricative (cf. also Macken 1975 and 1976a). Before being produced correctly, the fricatives were replaced by the homorganic voiceless stops, back consonants by front ones, and the r-phonemes usually by |l|--a set of substitutions predicted by Jakobson.

When compared to other children acquiring Spanish, Si's data are identical in at least the additional, following ways: /n/ was acquired in final position before /s/, with both before final /l/ or /r/; learning the allophonic relationship of stop-spirant for the voiced stop phonemes proved difficult and the earliest stage was one in which the voiced stops were usually produced as glides and [ɐ] in some ways patterned with the liquids (cf. also Stoel 1974); many aspects of the co-occurrence of consonants in words were determined by a strength hierarchy in which voiceless stops (and nasals in the earliest stages) are stronger than voiceless fricatives (Macken 1975 and 1976a). In addition, a wide range of phonetic variation (section 3.0) and the exceptional status of some lexical items (e.g. Si's mira and guau guau, section 4.0, and the 'frozen forms' in section 6.0) were seen in all the Spanish subjects and are probably universal.

7.3 On individual differences

Some aspects of Si's development appear to be uniquely characteristic of Si among the six subjects studied; other aspects are unique only in the frequency with which they occur in her corpus. For example, all subjects imitated to some degree at some point: Si imitated more than any other subject; J, another subject, imitated rarely until the age of 2;1, when he began to imitate a great deal. Si coalesced several learned routines into a single unit (e.g. *¿qué es?* 'what is' → [kes] and unit phrases like 'mommy home'); most subjects did this only with *¿donde está?* 'where is' (which was produced, as in Spanish baby talk, as [p ta]) and one subject never use such forms. Si was the only subject who produced many 'misperceptions' (section 3.0).

As was pointed out before (section 4.0), there are certain parallels between Si's general language behavior and aspects of her phonological development, as for example between the coalesced routines and the 'coalesced' word patterns. The misperceptions suggest a global, only partly differentiated auditory processing which is paralleled by her loose, prosodic treatment of words. The pattern which emerges is consistent in several ways if we view Si as a child whose preferred processing mode is a global one rather than a detail or analytic one⁷. Within this context of an information-processing model for interpreting individual differences (see in particular Zelnicker and Jeffrey 1976), the difference between Si and a child like J as a global versus a detail processing child relates several aspects of their language behavior with specific differences between their phonological development (see Macken 1976b for a fuller discussion). This view would predict that the tendencies to scan an entire three of four syllable word for pattern-criterial consonants, to use several different syllable reduction rules and to have substitution rules sensitive to word position and pattern goals would occur together and be of significantly greater frequency in the phonology of global children such as Si than in the phonology of non-global children like J. This analysis of differences in terms of cognitive styles is a reasonable extension of a cognitive model of phonology which emphasizes the problem-solving nature of acquisition and is promising in that it may--if successful--restrict the range of individual phonological differences to several sets or syndromes typical of different styles.

7. Peters 1977 reports on the language of a somewhat 'unintelligible' child who used two types of speech, 'analytic' and 'gestalt'. Peters suggests that these two types of speech may reflect two language learning strategies which may be used to different degrees by different children. This contrast of 'analytic' versus 'gestalt' is similar in some respects to the 'detail' versus 'global' cognitive style dichotomy of Zelnicker and Jeffrey 1976.

In addition to the possible set of restrictions on individual differences deduced from a set of basic preferences in processing styles, it appears that the particular structure of the language being learned may also restrict the number and type of individual differences among children learning that language. Although Si is the only subject so far to have such a strong preference for word initial labial (and subsequently word initial labial and velar) word patterns, it may be that in part this particular preference reflects a particular property of Spanish: Hooper 1976 suggests that in Spanish labial and velar consonants are considerably stronger than dental consonants in syllable initial position. It seems reasonable to expect that the different ways in which children organize their phonology will reflect differential selection and emphasis of particular aspects from the complete, possible set of complex relationships that obtain in the particular language being acquired (Macken 1976b).

REFERENCES

- Alarcos Llorach, E. 1950. Fonología Española. Madrid: Editorial Gredos. (Third Edition, 1961).
- Bloom, Lois, Lois Hood and Patsy Lightbown. 1975. Imitation in language development: if, when and why. Cogn. Psych. 6.380-420.
- Bower, T.G.R. 1974. Repetition in human development. Merrill-Palmer Quarterly. 20.303-318.
- Bush, C.N., M.L. Edwards, J.M. Luckau, C.M. Stoel, M.A. Macken, and J.D. Petersen. 1973. On specifying a system for transcribing consonants in child language: a working paper with examples from American English and Mexican Spanish. Stanford University: Department of Linguistics.
- Cruttenden, A. 1970. A phonetic study of babbling. Brit. J. of Disorders of Communication. 5.110-117
- Dalbour, John B. 1969. Spanish Pronunciation: Theory and Practice. New York: Holt, Rhinehart and Winston.
- Farwell, Carol B. 1976. Some strategies in the early production of fricatives. Papers and Reports on Child Language Development. 12.97-104.

Ferguson, Charles A. 1977a. Learning to pronounce: the earliest stages of phonological development in the child. In F.D. Minifie and L.I. Lloyd (Eds.), Communicative Competence and Cognitive Abilities--Early Behavioral Assessment. Baltimore: University Park Press.

_____. 1977b. New directions in phonological theory: language acquisition and universals research. In Roger W. Cole (Ed.), Current Issues in Linguistic Theory. Bloomington: Indiana University Press.

_____. and Carol B. Farwell. 1975. Words and sounds in early language acquisition. Lg. 51(2).419-439.

_____. and Olga K. Garnica. 1975. Theories of phonological development. In E. and E. Lenneberg (Eds.), Foundations of Language Development, Volume II. New York: Academic Press.

_____. David B. Peizer and Thelma E. Weeks. 1973. Model-and-replica phonological grammar of a child's first words. Lingua 31.35-65.

Fromkin, Victoria A. (Ed.). 1973. Speech Errors as Linguistic Evidence. The Hague: Mouton.

Greenberg, Joseph P. and James J. Jenkins. 1964. Studies in the psychological correlates of the sound system of American English. Word 20(2).157-177.

Hooper, Joan. 1976. An Introduction to Natural Generative Phonology. New York: Academic Press.

Ingram, David. 1974a. Fronting in child phonology. J.Ch.Lg. 1.233-241.

_____. 1974b. Phonological rules in young children. J.Ch.Lg. 1.49-64.

Jakobson, Roman. 1941/1968. Child Language, Aphasia and Phonological Universals. The Hague: Mouton. (Translated by A. Keiler, 1968.)

Kiparsky, Paul and Lise Menn. 1977. On the acquisition of

phonology. In J. MacNamara (Ed.), Language Learning and Thought. New York: Academic Press.

Labov, William, Malcah Yaeger and Richard Steiner. 1972. A Quantitative Study of Sound Change in Progress. Volume I. Philadelphia: U. S. Regional Survey.

Macken, Marlys A. 1975. The acquisition of intervocalic consonants in Mexican Spanish: a cross sectional study based on imitation data. Papers and Reports on Child Language Development 9.29-42.

_____. 1976a. Permitted complexity in phonological development: one child's acquisition of Spanish consonants. Papers and Reports on Child Language Development. 11.28-60. (To appear Lingua).

_____. 1976b. Individual differences in phonological acquisition: strategy versus cognitive style. Paper presented to the Child Language Seminar Series, Stanford University, May 1976.

Menn, Lise. 1971. Phonotactic rules in beginning speech. Lingua 26.225-251.

_____. 1974. A theoretical framework for child phonology. Paper given at the summer meeting of the Linguistic Society of America, Amherst, Mass.

_____. 1976. Evidence for an interactionist-discovery theory of child phonology. Papers and Reports on Child Language Development. 12.169-177.

_____. 1977. Phonological units in beginning speech. Paper prepared for the Symposium on Segment Organization and the Syllable. To be held October 21-23, 1977, Boulder, Colorado.

Moskowitz, Arlene I. 1971. The two-year-old stage in the acquisition of English phonology. Lg. 46(2).426-441.

_____. 1973. The acquisition of phonology and syntax: a preliminary study. In K.J.J. Hintikka, J.M.E. Moravcsik and P. Suppes (Eds.), Approaches to Natural Language. Dordrecht, Holland: Reidel.

Piaget, Jean. 1952. The Origins of Intelligence in Children. New York: International University Press.

Smith, Neilson V. 1973. The Acquisition of Phonology, A Case Study. Cambridge: University Press.

----- 1975. Universal tendencies in the child's acquisition of phonology. In N. O'Connor (Ed.), Language, Cognitive Deficiencies and Retardation. London: Butterworths.

Stockwell, Robert P. and J.D. Bowen. 1965. The Sounds of English and Spanish. Chicago: University of Chicago Press.

Stoel, Caroling M. 1974. The Acquisition of Liquids in Spanish. Unpublished Ph.D. dissertation. Stanford University.

Vihman, Marilyn M. 1977. Consonants harmony: its scope and function in child language. In J.P. Greenberg, C.A. Ferguson and E.A. Moravcsik (Eds.), Universals of Human Language. Stanford: Stanford University Press. (To appear 1977.)

Waterson, Natalie. 1971. Child phonology: a prosodic view. J. Ling. 7. 179-211.

Zelnicker, Tamar and Wendell E. Jeffrey. 1976. Reflective and Impulsive Children: Strategies of Information Processing Underlying Differences in Problem Solving. Society for Research on Child Language Development Monograph 168.